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Occurrence of exact R^2 inflation in non-local UV-complete gravity

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Abstract

© 2016, The Author(s).The R + R2, shortly named “R2” (“Starobinsky”) inflationary model, represents a fully consistent example of a one-parameter inflationary scenario. This model has a “graceful exit” from inflation and provides a mechanism for subsequent creation and final thermalization of the standard matter. Moreover, it produces a very good fit of the observed spectrum of primordial perturbations. In the present paper we show explicitly that the R2 inflationary spacetime is an exact solution of a range of weakly non-local (quasi-polynomial) gravitational theories, which provide an ultraviolet completion of the R2 theory. These theories are ghost-free, super-renormalizable or finite at quantum level, and perturbatively unitary. Their spectrum consists of the graviton and the scalaron that is responsible for driving the inflation. Notably, any further extension of the spectrum leads to propagating ghost degrees of freedom. We are aimed at presenting a detailed construction of such theories in the so called Weyl basis. Further, we give a special account to the cosmological implications of this theory by considering perturbations during inflation. The highlight of the non-local model is the prediction of a modified, in comparison to a local R2 model, value for the ratio of tensor and scalar power spectra r, depending on the parameters of the theory. The relevant parameters are under control to be successfully confronted with existing observational data. Furthermore, the modified r can surely meet future observational constraints.

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Keywords

Cosmology of Theories beyond the SM, Models of Quantum Gravity